

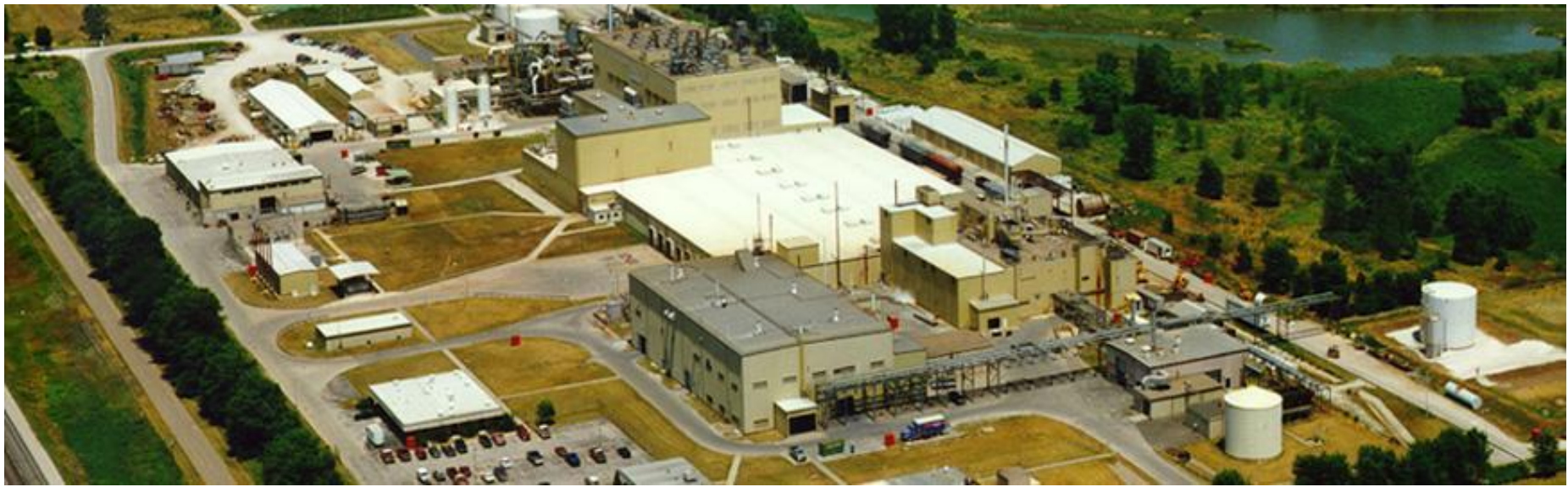
BIOREMEDIATION



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*Biology, Chemistry, & Physics Teacher
at Easton Valley High School*

2021 extern at Climax Molybdenum %
Lee County Conservation Center



Climax Molybdenum Company, a subsidiary of Freeport-McMoRan, is the world's premier source for upgraded molybdenum chemical products. Located on the banks of the Mississippi River in southeast Iowa, the Ft. Madison facility is the world's largest and highest quality producer of lubricant grade molybdenum disulfide, sublimed pure molybdic oxide, calcined pure molybdic oxide, ammonium dimolybdate, ammonium heptamolybdate, ammonium octamolybdate, and sodium molybdate.

The Fort Madison chemical plant, operational since late 1977, is an important companion to other conversion and operating facilities of Climax Molybdenum Company. The plant was expanded in 1995, maintaining its status as the largest facility of its type in the world.

A key function of this chemical facility is to supplement the growing family of molybdenum products required for many new applications warranted by the technological merits of molybdenum. Fort Madison is dedicated to being the highest quality producer in the world and a strong member of the Climax global production team. The efforts to meet or exceed customer requirements have been a prime focus for the high purity products from this location. The efforts and dedication resulted in many customer quality awards.



Climax Molybdenum and Lee County Conservation both own acreage along the Mississippi River in Lee County, Iowa.

The mission of the Lee County Conservation Board is to promote conservation of local natural resources and to provide parks and conservation areas, outdoor recreational opportunities, and environmental education for the public. Lee County Conservation manages 29 individual parks, wildlife areas, historic sites and water recreation access points - encompassing some 2634 acres across the county. It is located in the most extreme southeast corner of Iowa. A few amenities and activities they offer include:

- Camping and Cabin Rentals
- Educational Programs
- Hiking and Bike trails
- Numerous Hunting and Fishing Opportunities

Workplace Focus

Aside from several side projects at Climax Molybdenum and Lee County Conservation, I have focused on the photographic and textual documentation of ways that Climax Molybdenum has improved the **ecological quality** on its acreage, and on proposing other ways Climax Molybdenum could improve the ecological quality on its acreage in the near future, including, but not limited to, public inclusion in such projects and public education thereof.

I focused on the following categories of **organisms** to that end: prairie plants, riparian trees, pollinators, freshwater mussels, and aquatic insects.

Project, Problem, & Product

Project

Biology, chemistry, and physics students will participate in science fair-style investigations to be referred to as **original investigations**, not science fair projects.

Problem

Each student group will devise and conduct an original investigation linked to:

- a NGSS Engineering standard
- a personal interest
- their course subject (biology, chemistry, or physics)
- the main driving theme: **Bioremediation**

Bioremediation is a process used to treat contaminated media, including water, soil and subsurface material, by altering environmental conditions to stimulate growth of microorganisms and degrade the target pollutants. HOWEVER, for the purposes of this project, **bioremediation shall be defined more broadly** to refer to any organism or abiotic method that improves the amount or quality (or maintains the number or current quality) of any ecologically beneficial biological organism (plant, animal, or otherwise) or an abiotic ecological factor.

Public Product

Each student group will interact with other groups at points during, and especially after, their investigations are complete. Students will publish their findings in a public forum. Each student project will include interaction with one or more hosts. Each student project will interact with and/or benefit the environment outside the school.

Standards, Targets, and Driving & Essential Questions

Classroom Standards

See the website: <https://sites.google.com/eastonvalleycsd.com/climaxecology>

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Learning Targets

Each student group will:

1. Form a viable and original hypothesis, research question, or problem statement
2. Compile a list of proposed materials needed and possible methods to use
3. Collect qualitative and quantitative data
4. Construct data tables, process raw data statistically, construct graphs of processed data
5. Analyze data, summarize the analysis in writing, and draw and record conclusions
6. Evaluate the above components and suggest meaningful and realistic improvements

Throughout the process, students will demonstrate:

1. Self-motivation, perseverance, & valuing the learning experience
2. Collaboration, communication, & respect
3. Self-awareness of strengths & weaknesses

*Driving Questions**

*Underlying/Essential Questions**

Specific questions to fit the above categories shall emerge organically while coaching students through the scientific process, including their meeting the learning targets and problem parameters listed on the previous two slides.

Some very basic questions, or at least examples thereof, are found throughout the pages of the website which shall serve as an introduction to the theme of the project and as a source of reference materials.

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**to help move students toward classroom standards, learning targets, and the eventual solution of the project/problem*

Extern Hosts' Roles

Roles of Hosts

- Hosts shall be a source of professional knowledge and Insight.
- Hosts may be a co-facilitator of some or all of the public product / community engagement aspects of student work.

Names and Titles of Hosts

- Clay Steele, *Naturalist*, LCCB
- Emily Benjamin, *Community Development Specialist*, CMC
- Alexandra Bruns, *Engineer*, CMC
- John Rockwell, *Chief Chemist*, CMC

Design Elements Checklist

1. Challenging Problem or Question ✓
2. Sustained Inquiry ✓
3. Authenticity ✓
4. Student Voice and Choice ✓
5. Reflection ✓
6. Critique and Revision ✓
7. Public Product ✓